

Rolling Process Cheat Sheet

Draft, volume flow, contact length, force and power

ENGINEERING
CHEAT SHEET

Key equations

Quantity	Equation	Notes
Draft	$d = t_o - t_f$	Thickness reduction per pass
Constant volume	$t_o w_o L_o = t_f w_f L_f$	From the post
Constant volume flow rate	$t_o w_o v_o = t_f w_f v_f$	Exit speed rises as thickness falls
Forward slip	$s = (v_f - v_r) / v_r$	Textbook form; post defines v_r roll speed, v_f exit speed
Contact length	$L = \sqrt{(R d)}$	Textbook form (R = roll radius)
Maximum draft	$d_{\max} = \mu^2 R$	Textbook form (μ = friction coefficient)
Rolling force	$F = L w Y_{\text{avg}}$	Textbook form (w = width, Y_{avg} = average flow stress)
Rolling power	$P = 2\pi N F L$	Per roll pair, N in rev/s; matches the post's variables

Key takeaways

- Roll gap is smaller than the incoming thickness, so friction and compression elongate the metal; width change is usually small.
- Hot rolling starts above recrystallization (steel above about 1000 °C) and converts cast structure to wrought: bloom, billet, slab.
- Cold rolling suits stainless steel, titanium and nickel alloys for sheet, plate and strip.
- Bloom: thickness over about 152 mm and width up to twice thickness. Slab: width more than twice thickness.
- Related processes: ring rolling, shape rolling (I-beams, channels), thread rolling (stronger, no chips), skew rolling for balls.
- Flat-rolling defects: edge cracks, zipper cracks, alligatoring, wavy edges, surface marks, non-uniform thickness.
- The post's contact length, maximum reduction, force and forward-slip equations are images, so those entries are textbook forms.